



## Goddard Procedural Requirements (GPR)

**DIRECTIVE NO.** GPR 1860.4  
**EFFECTIVE DATE:** January 26, 2005  
**EXPIRATION DATE:** January 26, 2010

**APPROVED BY Signature:** Original Signed by  
**NAME:** Edward J. Weiler  
**TITLE:** Director

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### COMPLIANCE IS MANDATORY

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**Responsible Office:** 250 / Safety and Environmental Division

**Title:** Ultraviolet and High Intensity Light (UV/HIL) Radiation Protection

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#### PREFACE

#### P.1 PURPOSE

This directive sets forth the Goddard Space Flight Center's (GSFC) Ultraviolet (UV) and High Intensity Light (HIL) Radiation Protection Program and contains administrative direction and guidance on organizational and procedural requirements. This directive also provides essential UV and HIL radiation protection information. Only UV and HIL radiation is covered in this guide; other types of radiation are covered in other documents.

#### P.2 APPLICABILITY

This directive is applicable to all GSFC personnel, facilities, and activities, including all permanent and temporary sites. This directive shall also apply to all GSFC tenant organizations, contractors, grantees, clubs and other persons operating on GSFC property as required by law and as directed by contractual, grant, and agreement documents.

#### P.3 AUTHORITY

- a. National Aeronautics and Space Act of 1958 as amended {42 U.S.C. §§2451-2484}
- b. [NPD 8710.2](#), NASA Safety and Health Program Policy

#### P.4 REFERENCES

- a. American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs), latest edition.
- b. American National Standards Institute (ANSI), AWS Z49.1, Safety in Welding and Cutting and Allied Processes

#### P.5 CANCELLATION

GHB 1860.4, Ultraviolet and High Intensity Light Radiation Safety Handbook, December 31, 1979

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## P.6 SAFETY

N/A

## P.7 TRAINING

N/A

## P.8 RECORDS

Record Title	Record Custodian	Retention
Radiation Safety Committee (RSC) reviews, and Radiation Protection Officer (RPO) area inspection reports, both of which determine that UV/HIL source is potentially hazardous.	Safety and Environmental (S&E) Division, Protection Officer	*NRRS 1-124. Transfer to Federal Records Center when 3 years old. Destroy 10 years after transfer.

\*NRRS – NASA Records Retention Schedules ([NPR 1441.1](#))

## P.9 METRICS

Metrics shall include the number of harmful employee exposures and the number of HIL/UV incidents, and shall be reported by the Radiation Protection Officer quarterly to the Radiation Safety Committee (RSC).

## P.10 DEFINITIONS

**a. Custodian** – Any user who has been designated by the appropriate management and approved by the RSC to assume the responsibility of accountability for specific sources of UV/HIL radiation.

**b. User** – Any employee or contractor who has been approved by management to use specific sources and devices that emit UV/HIL radiation for specific purposes and at specific locations.

## P.11 ACRONYMS

ACGIH – American Conference of Governmental Industrial Hygienists

ANSI – American National Standards Institute

BEI – Biological Exposure Index

GSC – Goddard Safety Council

GSFC – Goddard Space Flight Center

HIL – high intensity light

OSHA – Occupational Safety and Health Administration

PPE – Personal Protective Equipment

RPO – Radiation Protection Officer

RSC – Radiation Safety Committee

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TLV – Threshold Limit Values  
UV – ultraviolet  
WFF – Wallops Flight Facility

## PROCEDURES

In this document, a requirement is identified by “shall,” a good practice by “should,” permission by “may” or “can,” expectation by “will,” and descriptive material by “is.”

### 1. ROLES AND RESPONSIBILITIES

**1.1 Goddard Safety Council (GSC)** – The GSC shall oversee development, direction, and implementation of GSFC’s Health and Safety Program, including radiation protection.

**1.2 Radiation Safety Committee (RSC)** – The RSC is responsible to the GSC for overseeing development, direction, and implementation of GSFC’s Radiation Protection Program. The RSC shall evaluate requests for committee action and, if satisfied that safe use will be made of the sources, shall approve uses of UV/HIL radiation sources. Approvals may be provided subject to certain requirements or restrictions imposed by the Committee. The Committee reserves the right to suspend all approvals if the requirements of GSFC’s Radiation Protection Program and requirements of approval are not complied with. The Committee may designate a person or persons to give approval for routine requests. The RSC chairman may act on behalf of the RSC as necessary. All actions shall be reported to the RSC at the next meeting. The RSC consists of representatives from various directorates with varying areas of expertise. The RSC shall:

- (1) Be chaired by an individual designated by the Chief, Safety & Environmental (S&E) Division;
- (2) Meet at least quarterly, and as often as necessary to accomplish its responsibilities;
- (3) Ensure that UV/HIL radiation used at GSFC, or under GSFC programs, is managed so as to minimize the health and safety risks to government and contractor employees and the public;
- (4) Ensure that GSFC and other federal regulations, professional standards, and sound health physics practices are met; and
- (5) Approve UV/HIL operations and, if necessary, prescribe conditions and requirements to minimize radiation hazards

### 1.3 **S&E Division**

S&E staff has responsibility for UV/HIL radiation protection at GSFC and shall provide consultation and support to all GSFC organizations. S&E shall designate the Radiation Protection Officer (RPO) for GSFC.

#### **1.4 Wallops Flight Facility (WFF) Safety Office**

The WFF Safety Office shall designate a radiation protection point of contact that shall provide review and preliminary approval for UV/HIL activities at or managed by WFF. The WFF RPO shall provide a list of preliminary approvals that have been granted at the quarterly RSC meetings. The WFF Safety Office shall be the office of record for all documents and use programs to assure compliance with RSC requirements relating to UV/HIL radiation at that facility.

#### **1.5 Radiation Protection Officer (RPO)**

The RPO shall provide for the evaluation of potentially hazardous UV/HIL-emitting devices and equipment. The RPO is the primary point of contact for all radiation safety emergencies.

#### **1.6 Custodians**

Custodians shall assure that only appropriately trained users operate specific devices or sources of UV/HIL radiation.

#### **1.7 Employees**

Employees involved in radiological activities are responsible for knowing and observing GSFC radiological safety regulations. Employees shall immediately report to their supervisor all unsafe conditions or operations involving radiation emitting sources or devices.

### **2. ADMINISTRATIVE PROCEDURES**

The objectives of this section are to define potentially hazardous UV/HIL radiation sources and to establish methods of handling approval procedures, and methods of assuring that work with these sources is performed with due regard for radiation safety.

#### **2.1 Potentially Hazardous Sources of UV/HIL Radiation**

Pulsed or continuous-wave systems capable of producing light of wavelengths from 200 nm to 400 nm are sources of UV radiation. UV below 200 nm is not covered in this document because this is considered “vacuum” UV and would not be capable of producing personnel exposure in a standard work environment. HIL sources include compact arc lamps, tungsten-halogen lamps, electronic flash lamps, and other sources of high irradiance. Many HIL sources may also produce UV along with visible and infrared radiation. A “hazardous” UV/HIL producing device would have the potential for emissions above the Threshold Limit Values shown in the ACGIH TLV reference booklet.

#### **2.2 Qualified Personnel**

Personnel who may expose themselves or others to potentially hazardous sources of UV/HIL radiation shall have sufficient training and experience to perform their work in a safe manner. This includes both Government and contractor workers. Supervisors are responsible for ensuring that their workers are

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aware of potential UV/HIL hazards, as well as any other hazards, in the areas where they work and limit the exposure of UV/HIL radiation to themselves and others to the lowest practical minimum.

### **2.3 UV/HIL Source Custodian**

For all sources of potentially hazardous UV/HIL the custodian of the device shall prepare a request for evaluation of the proposed source and its use and submit the request to the RPO for evaluation. The custodian is responsible for the safe use of all UV/HIL emitters under his/her control.

### **2.4 RPO Evaluation Requirements**

The RPO shall review and evaluate custodian requests to determine if there is a potential for hazardous radiation from the device. This evaluation shall be based on the limits established by the ACGIH.

### **2.5 RSC Review Requirements**

If the RPO review identifies a potential for personnel exposure above the ACGIH limits, the custodian of the device shall prepare a safety plan that contains the procedures to be used to minimize personnel exposure. The request for RSC review should describe the UV/HIL source and its planned use adequately enough to show that it could be used in a safe manner. The safety plan shall list all personnel who will be operating the device. Each of the individuals shall be properly trained prior to its operation.

### **2.6 Field Operations**

2.6.1 Field operations using radiation-producing devices differ significantly from indoor laboratory operations. Field stations shall submit the following for review:

- a. Information concerning equipment design, installation, and interlocks;
- b. Information describing programs to periodically verify proper functioning of interlocks and other protective devices, and to measure radiation levels of exposed areas;
- c. Maintenance procedures and radiation hazards associated with the equipment; and
- d. Safety procedures used during operations and method of enforcement.

2.6.2 The RSC shall use the information described in 2.6.1 to:

- a. Ensure that equipment is properly designed and installed, and that interlocks exist to prevent radiation leaking into unprotected or uncontrolled areas where people could be exposed;
- b. Ensure that a satisfactory program exists to periodically verify proper functioning of interlocks and other protective devices, and to measure radiation levels of all exposed areas;
- c. Establish training standards for maintenance personnel to ensure that they adequately understand both proper maintenance procedures for the specific equipment, and the radiation hazards associated with that equipment; and

- d. Ensure that safety procedures appropriate to each installation are developed and are enforced by station management.

### 3. RADIATION PROTECTION GUIDELINES

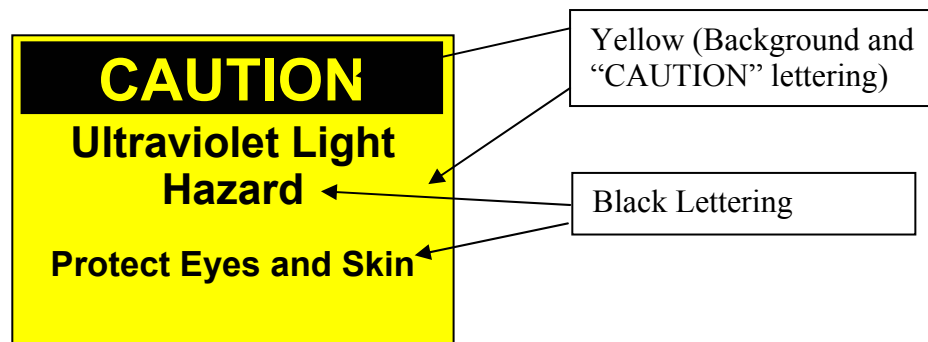
The objective of this section is to provide radiation protection guidelines for the safe use of UV/HIL radiation sources.

#### 3.1 Exposure Limits for Personnel

The Occupational Safety and Health Administration (OSHA) Act of 1970 incorporates, by reference, the ACGIH TLVs for biological exposure to UV/HIL and shall be used to limit personnel exposures.

#### 3.2 UV/HIL Warning Sign

The source custodian shall be responsible for procuring and posting warning signs where the potential for UV/HIL exposure is possible. Any signs used shall be of the standard OSHA configuration with colors of black lettering on a yellow background. At a minimum, the sign shall have the following information and format (substitute the words “High Intensity” for HIL):



#### 3.3 Exposure Control

If an evaluation of UV/HIL source determines that there is a potential for exposure above the ACGIH limits, the following measures may be used to reduce unnecessary exposures:

- a. Where feasible, UV/HIL devices should be located to minimize exposures in areas adjacent to and within the NASA installations. All hazardous areas within the NASA installations should be conspicuously posted with appropriate warning signs. Evaluation of each anticipated operating condition shall include consideration and development of procedures for insuring proper placing of warning signs for that operation. Local standard operating procedures shall prescribe procedures for the placing of temporary or permanent signs during periods of operations. Signs such as those described in paragraph 3.2 above shall be used.

- b. Where operation allows, UV/HIL sources should be enclosed in order to minimize the extent of exposure areas, thus reducing unnecessary hazards.
- c. The use of barriers and interlocks may be used to prevent ingress by personnel into hazardous areas.
- d. Personal protective equipment (PPE) such as optically coated eyewear and skin barrier creams should be used where necessary. PPE should not be the option of choice when engineering controls could limit personal exposure.

### 3.4 Medical Considerations

- a. The employee's past medical history should be obtained to determine if he/she suffers from any condition that is exacerbated or aggravated by exposure to sunlight or UV radiation.
- b. An employee who gives a history of such a condition should not be permitted to work in an area exposed to UV radiation.
- c. The employee should be advised that any blemish appearing on skin exposed to long-term UV radiation should be examined by a physician.

### 3.5 Apprise Employees of Hazards from Exposure to UV/HIL energy

Each employee who may be exposed to hazardous UV/HIL shall be apprised of all hazards, relevant symptoms, and precautions concerning exposure. This appraisal of hazards shall include:

- a. Information as to the proper eye protection, skin protection, and protective clothing to be used;
- b. Instruction on how to recognize the symptoms of eye and skin damage due to UV radiation;
- c. Information as to special caution that shall be exercised in situations where employees are exposed to toxic agents and/or other stressful physical agents which may be present in addition to, and simultaneously with, UV radiation; and
- d. Highly susceptible (i.e., light skinned, easily sunburned) employees who regularly work out-of-doors and are exposed to sunlight should be apprised of possible long-term effects of sun exposure and of the desirability of preventing these effects by the use of PPE or sunscreens.

### 3.6 Work Practices

- a. Worker exposure to UV energy from 200 nm to 400 nm shall be controlled by adherence to the standards set forth in paragraph 3.3 or the preventive procedures described in this section, as applicable. Compliance with the standard, based on measurement data or emission data, or adherence to the work practice procedures will protect against injury from UV energy.
- b. Exposure to UV energy can be controlled by enclosures, shields, protective clothing, skin creams, gloves, goggles, and/or face shields. Employees shall be protected from eye or skin exposure to UV radiation depending on the sources below:
  - (1) Sunlight – Susceptible persons working outside in strong sunlight should be protected. Protective clothing, such as long-sleeved shirts, trousers or skirt, and face and neck protection will normally be adequate. A broad-brimmed hat can afford face and neck protection, as well as a billed-hat or cap or neck shield (if the neck is not protected by hair). Hard hats may have bills or face shields to protect the face, and may have neck shields. Alternatively, barrier creams and goggles or spectacles can achieve face and eye protection.

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- (2) Low-intensity UV sources – Examples of sources of low-intensity UV sources are low-pressure mercury-vapor lamps, sunlamps, and black-light lamps. Glass or plastic (1/8 inch thickness or greater) spectacles, goggles, or shields provide adequate eye protection. Lightweight clothing can protect skin, as well as skin creams containing benzophenones or p-aminobenzoic acid, or barrier creams containing titanium dioxide or zinc oxide.
- (3) High-intensity UV sources – Examples of high-intensity UV sources are high-pressure mercury vapor lamps, high-pressure xenon arcs, xenon-mercury arcs, carbon arcs, plasma torches and welding areas.

- c. For eye protection, employees shall wear goggles, face shields or masks. The ACGIH guide should be reference for shade (transmission density) required for this eye protection.
- d. Skin shall also be protected. Clothing of densely woven flannelette, poplin or synthetic fabric will give sufficient protection. Face shields can protect facial skin or shades specified in ANSI AWS Z49.1 or by barrier cream containing titanium dioxide or zinc oxide. Because many synthetic clothing fibers can melt or catch fire and thereby cause severe thermal burns, clothing of synthetic fibers should be flame-resistant if operations involve great heat, sparks, or flame.
- e. Welders' helpers and others working nearby may also require protection. Shielding such as the welders booth, guard against accidental exposure of other people. Reflection from lamp-housings, walls, ceilings and other possible reflective surfaces should be kept to a minimum by coating such surfaces with a pigment-based paint of low UV reflectance. Where such shielding and nonreflective surfaces are not used, welders' helpers and others near the welding operation should wear protective clothing, skin creams, gloves, goggles and/or face shields.

### 3.7 Additional Hazards

There are other hazards from some UV sources that shall also be prevented.

- a. Shock Hazard – There is a shock hazard in some operations involving arcs, because of the high starting voltages required. Wiring connections shall be adequately insulated to prevent shock.
- b. Ozone/Explosion Hazard – There shall be adequate ventilation to prevent build-up of ozone and oxides of nitrogen. There may also be an explosion hazard from some UV operations, and the wearing of gloves and face shields will reduce the consequences of an explosion.
- c. Flash or Startle Hazard – The use of flash lamps or high-powered strobes may present a startle hazard to other persons performing detailed tasks in other areas. Custodians of flash lamp systems shall make adjacent workers cognizant of the impending bright flash of these systems. Publishing an announcement with a date and time prior to commencement of flash lamp use may be in order.



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### CHANGE HISTORY LOG

Revision	Effective Date	Description of Changes
Baseline	01/26/05	Initial Release

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